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Visual intelligibility of words in isolation and in sentence context

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VISUAL INTELLIGIBILITY OF WORDS IN ISOLATION AND IN SENTENCE CONTEXT

Rationale for Study

Two of the basic problems of teachers of the profoundly deaf are: 1) how to teach deaf children new vocabulary and 2) how to optimize their understanding of the teacher's speech (with speechreading as the main sensory input). It would be helpful for the teacher to know the best way of insuring the child's reception of key words. That is, the teacher needs to know the best linguistic context in which to place a word for optimal visual reception through lipreading. Teachers follow certain strategies when they are not understood (Williams-Greer, 1972). One of these, "structural change," is the aspect dealt with in this study.

Introduction

Many early studies attempted to analyze the factors which influence an individual's ability or inability to speechread. Some of these studies dealt with the control of the stimulus material, an important variable (Heider & Heider, 1940). Oyer and O'neil (1961) stated, "The analysis of stimulus material used in lipreading is a very profitable research area. In fact, this area seems to offer the greatest possibility for future, controlled research."

However, many of the stimulus factors that seem to be important for communication through speechreading have been overlooked or ignored, such as the intelligibility (through speechreading) of a word in isolation vs its intelligibility in the context of a sentence. When testing young children with normal hearing, Blasdel and Jensen (1970) found that the fourth (last) syllable in a string of nonsense syllables was the one most often repeated correctly by the children. Conversely, Taaffe and Wong (1957) concluded that words which appear <u>early</u> in a sentence usually are easier to speechread. However, they used normally-hearing college students as subjects, and they did not control for complexity or sentence length.

This study was an attempt to examine the effects on speechreading performance of word position within a sentence. It is hoped that the information gained can help answer the following questions: 1) Are words

easier to speechread when they occur in isolation than when they occur in a sentence? 2) Does the position of a word in a sentence effect the word's intelligibility (through speechreading)?

Subjects

Fifteen profoundly deaf subjects, six males and nine females, were selected from the ratating department of Central Institute for the Deaf, according to their availability. The hearing losses of the subjects averaged over the speech range (500, 1 K, 2K Hz) were at least 95 dB with spondee-recognition scores of less that 30% (Erber, 1972). Each subject had had at least five years of formal education in an oral program. These subjects were also rated on a comparitive (with each other) scale by their teachers as to their relative lipreading ability.

Speech Stimuli

Twenty words in isolation (the selection of which was guided by lists compiled at C.I.D. during summer, 1972) and sixty sentences containing those words in initial, medial, and final positions were presented. The words were nouns (ten animate, ten inanimate), each used in isolation and as the subject, indirect object, and object of a proposition in sentences with lengths varying from 7 to 10 syllables per sentence. All verbs were transitive.

e.g. ball

The ball hit my brother on the head. (9 syllables)
That boy threw the ball over the fence. (9 syllables)
My dog chewed the cover off the ball. (9 syllables)

A language teacher familiar with the linguistic abilities of the subjects helped judge the appropriateness of the sentences and vocabulary.

Procedure

A teacher of the deaf served as the speaker. Mouth-level lighting was used to illuminate the speaker's oral cavity and to create optimal speechreading conditions.

The subjects viewed the presentations during one one-hour session with a break in the middle to minimize fatigue. Instructions were given in

both written and oral form by the experimenter before each test. In the set of directions for the isolated words, the subjects were instructed that they would see a speaker saying a word. They were instructed to write the word they thought the speaker said, even if they weren't sure. They were encouraged to guess but were cautioned that what they wrote down must be a word. For the sentence presentations, the subjects were instructed that they would see the speaker say a sentence. They were to write the complete sentence and were encouraged to guess if they were not sure of a part of the sentence. At the beginning of the test, the children were instructed (written) that they would see sentences. Before each change in stimulus material, the children were shown a card indicating "sentences" or "words".

The speaker was six to eight feet from the subjects. The observation area was lit for comfortable visual reception. Ten subjects were tested at a time, and they all viewed the speaker from within a $\pm$ 45° angle.

The words and sentences were spoken by the speaker in a quiet voice level with normal rhythm. The subjects were not allowed to use their hearing aids during the test. The speaker presented each of the words (in a random order) and sentences (in a random order) one time with a pause after each to allow the subjects time to write their responses (approximately 25 seconds for sentences and 10 seconds for words in isolation). Since the test was live, the length of the pause was not constant--enough time was allowed for all children to complete their written responses. Signal lights (yellow, red, green) provided additional cues to the subjects of when to get ready, when to watch, and when to write. These were controlled by the speaker. The stimulus material was presented in alternating fashion, fifteen sentences, five words, fifteen sentences, etc.

The responses were scored on the basis of one point per key word correct, regardless of whether the word occured in isolation or sentence context (e.g. Stimulus: The ball hit my brother John on the head. Response: The ball hit my brother Shawn on the head.= one point. The pet hit my brother John on the head.= 0 points). Homophonous words were considered incorrect, since the aim of the study was to determine the accuracy of speechreading words correctly in various contexts.

Results

It was found that the words in isolation were identified correctly more often than the words in any position in the sentences. Out of a possible score of 20 for the words in isolation, the mean score was 15.2 words correct. The mean number correct, with a possible score of 20, for words in the initial, medial and final positions in sentences was 10.1, 9.7 and 7.4, respectively (see Table 1. and Graphs 1 and 2).

The comparisons of scores on teacher rating of speechreading ability and scores on the tests are shown in Graphs 3 and 4. Although the results were not analyzed statistically (see "Discussion"), trends can be seen, especially in comparing teacher rating to the subjects' overall score on the three sentence aspects of the test. Generally, the better the teacher rating on speechreading ability, the better the score on the sentence aspect of the test.

Discussion

In light of other research regarding the relative ease of speechreading monosyllabic words ~~in isolation~~ and ~~in~~ sentences (Numbers & Hudgins, 1948), the results were surprising. The fact that these subjects were able to understand words better in isolation than in sentences may be an important factor to consider when communicating with a deaf child. Perhaps an important teacher strategy should be to repeat key words in isolation or at least in the initial position of a sentence. Whether these results can be generalized to young deaf children just beginning to learn language is still a matter for conjecture.

The fact that these subjects had the most difficulty with words at the end of a sentence also is interesting. In general, all nouns in the sentence seemed to receive equal stress. However, unlike Blasdel and Jensen's (1970) hearing subjects, the most recently presented word was not the most correctly perceived one. Perhaps this result supports the notion that by the time the subject sees the end of the sentence, he may be so confused by previously misinterpreted "context" that he does not understand the last words.

Several observations concerning construction, administration, and scoring of the test should be mentioned. Since the examiner was limited by length and structure of the sentences, many words were used quite

frequently. Additionally, the wording and ideas contained in the sentences were occasionally awkward. It also is difficult to control for contextual and syntactic cues with a test of this sort. These factors could have influenced the results of the test.

The examiner had to make some subjective judgements for the scoring. On eleven responses, the key word was written correctly by the subjects but it was not in the correct position. These were counted as correct responses and included in the data because the number of occurances was small. One subject consistently put an article "a" before the words presented in isolation and another subject put "a" in front of two words. These words also were scored as correct and used in the data. However, compound words were counted as incorrect, even though they contained the key words. Likewise the creation of a morphological change ("s", "ed", "ing", etc.) were counted as incorrect.

One final point concerns the teachers' ratings of the subjects. The teachers all claimed that it was impossible to rate the subjects in order from one to fifteen of relative speechreading ability. They felt that first of all it was extremely difficult, if not impossible, to separate speechreading ability from the subjects' overall receptive skills (which includes hearing or other cues and is influenced by language ability). Therefore, the examiner averaged the eight teachers' ratings and grouped the subjects into groups of good, medium, and poor speechreaders, according to these averaged ratings. The subjects' scores weren't drastically different for the speechreading of words. However, when their performance with the words in sentences were compared to the ratings, the subjects rated as "good" did better than those rate "medium", who did better than those rated "poor". Although the main purpose of this experiment was not to compare teacher ratings with scores on the speechreading tests, it is interesting to note the relationship. This may indicate that the kind of performance that was evaluated is indeed crucial to speechreading ability.

In summary, it was found that there was a difference between the subjects' ability to speechread words in isolation and in different positions in sentences. It must be remembered that the data were based on one speaker and that it may not be possible to generalize the results. Further research on this and other factors such as sentence length and complexity needs to be completed.

Table 1. Subjects, ages, teacher ratings and scores from speechreading test "Visual Intelligibility of Words In Isolation and In Sentence Context"

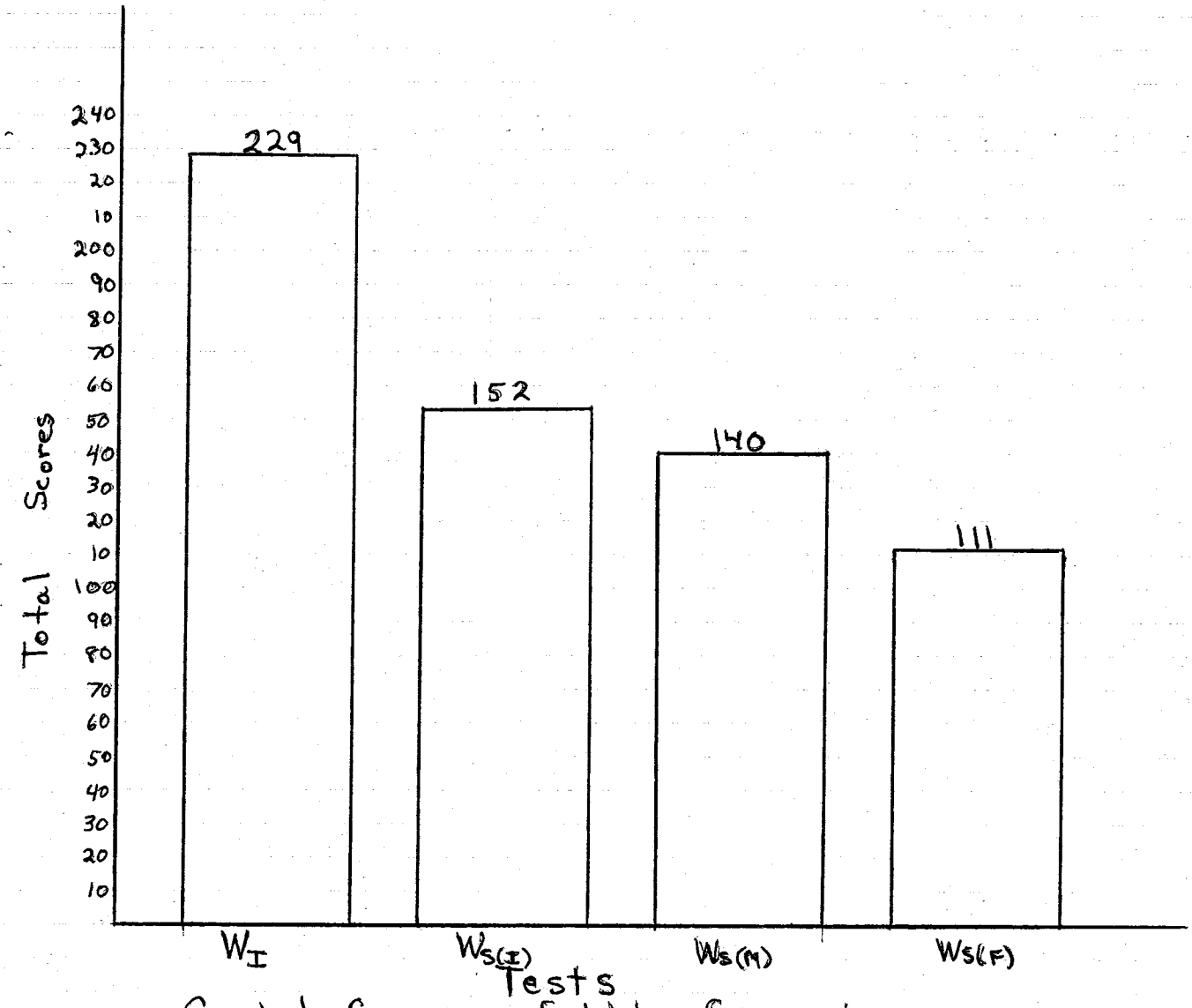
Subject	Age	Teacher Ratings	W_I*	$W_{S(I)}$**	$W_{S(M)}$+	$W_{S(F)}$++
1. C.B.	15-5	Good	19	13	13	9
2. M.H.	14-11	Good	18	11	15	17
3. B.M.	16-6	Good	17	13	12	9
4. G.F.	15-4	Medium	17	8	6	8
5. L.S.	15-0	Good	16	15	15	12
6. J.E.	15-6	Medium	16	11	14	6
7. T.S.	15-4	Poor	16	8	3	5
8. S.F.	16-11	Poor	16	8	7	2
9. P.F.	14-3	Medium	15	10	8	4
10. P.S.	13-7	Medium	15	11	11	10
11. H.F.	15-9	Medium	15	9	7	5
12. J.J.	15-5	Poor	15	12	10	7
13. J.S.	15-4	Good	13	10	13	6
14. O.N.	15-9	Poor	11	6	3	7
15. E.M.	15-3	Poor	10	7	3	4

* W_I--Words in isolation

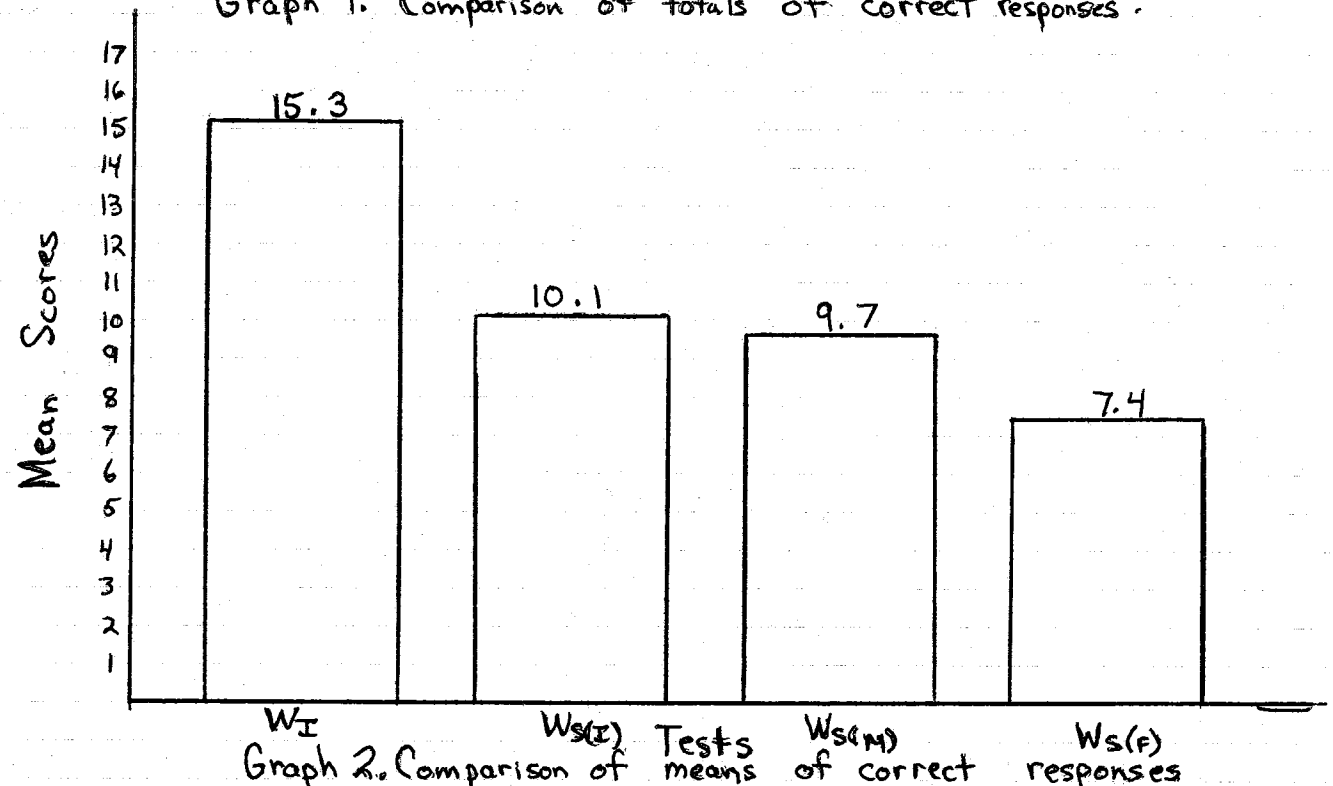
** $W_{S(I)}$--Words in the initial position in sentences

\+ $W_{S(M)}$--Words in the medial position in sentences

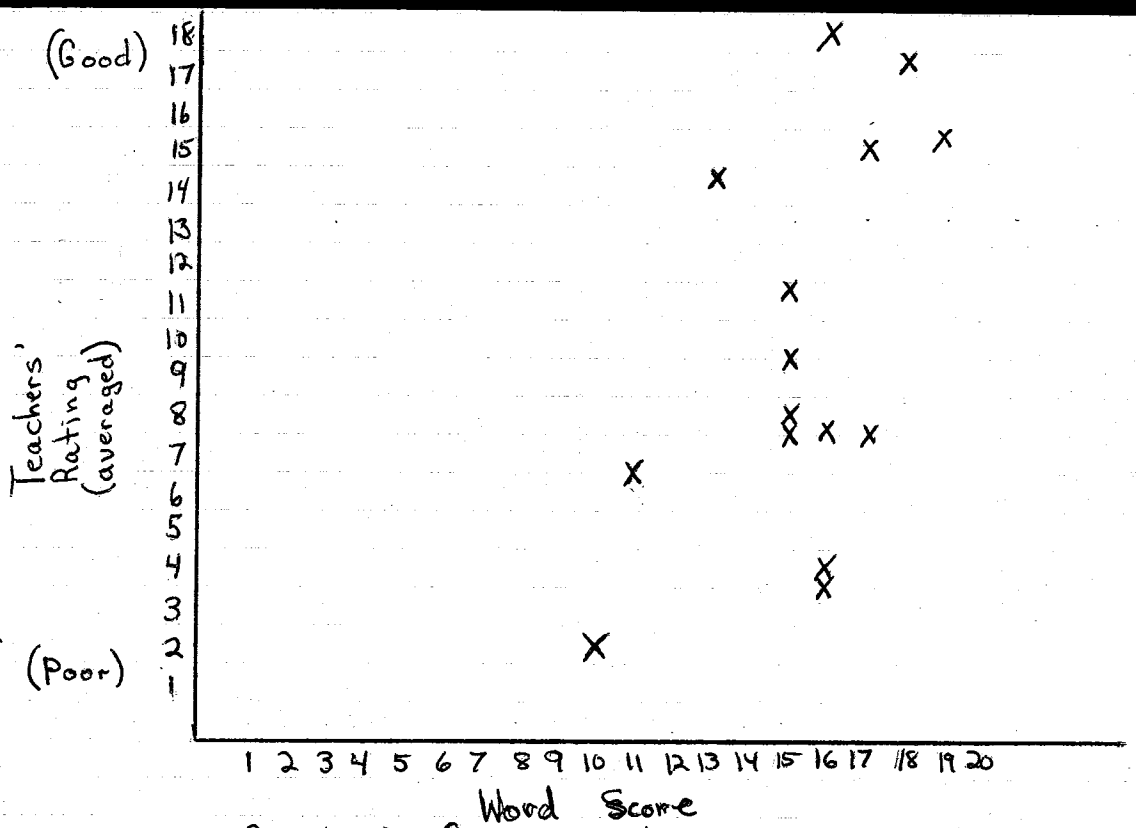
++ $W_{S(F)}$--Words in the final position in sentences



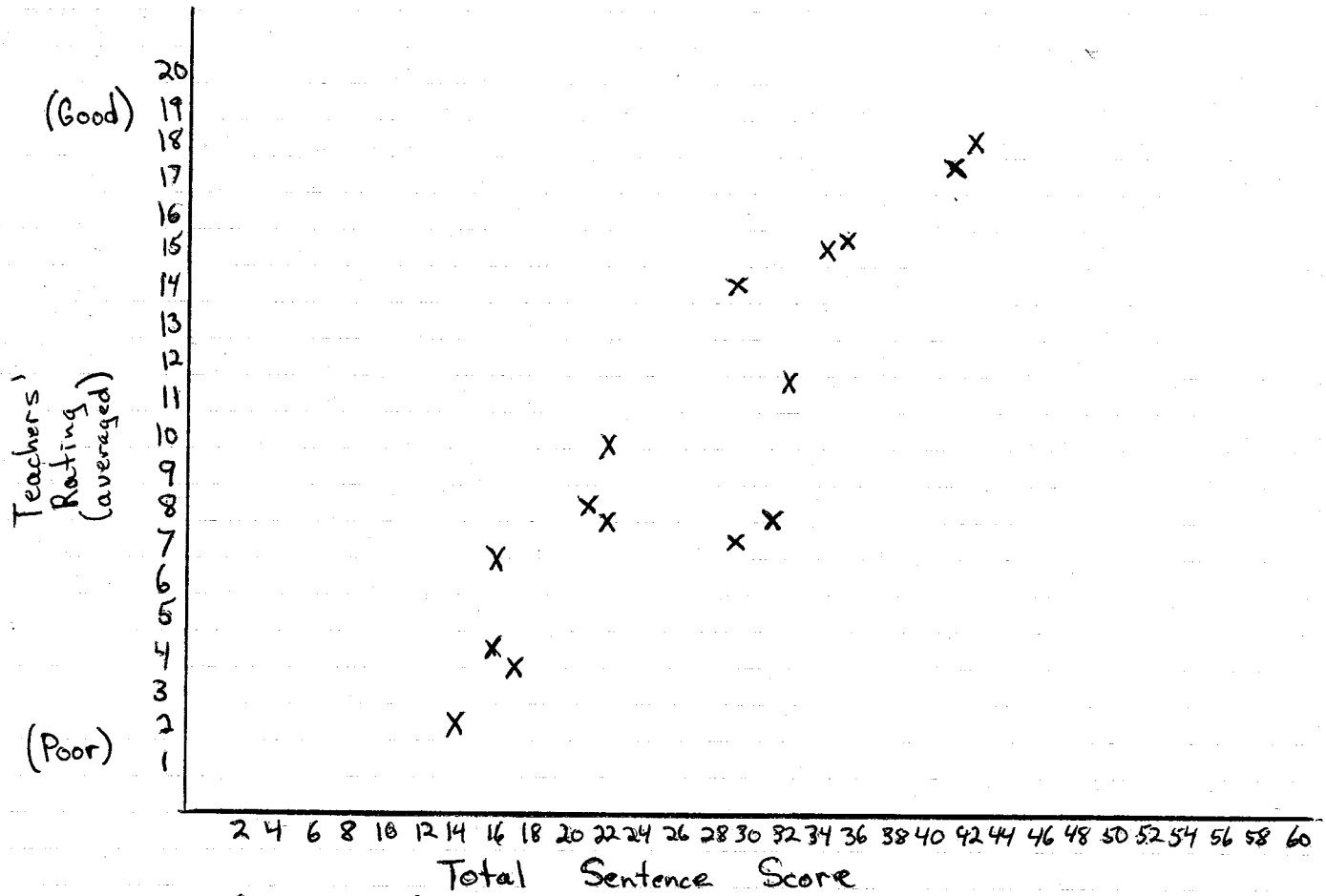
Graph 1. Comparison of totals of correct responses.



Graph 2. Comparison of means of correct responses



Graph 3. Comparing teacher ratings with subjects' scores for the words in isolation.



Graph 4. Comparing teacher ratings with subjects' scores for the words in sentences (all three positions).

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Sentences for Independent Study
VISUAL INTELLIGIBILITY OF WORDS IN ISOLATION
AND IN SENTENCE CONTEXT

S. The girl lost her shoe in the park. (8)

S. My sister hit me in the mouth. (8)

S. The boys saw the spoon on the table. (9)

S. That dog bit my brother on the leg. (9)

S. The children found a worm in the garden. (10)

1. ball (I)
   a. The ball hit John on the head. (7)
   b. That boy hit the ball over the fence. (9)
   c. My dog chewed the cover off the ball. (9)

2. bird (A)
   a. The bird ate the bread on the ground. (8)
   b. A man put the bird in a cage. (8)
   c. Two girls gave the food to the bird. (8)

3. boat (I)
   a. The boat had a motor in the back. (9)
   b. His father bought a boat for the race. (9)
   c. The men had seven fish in their boat. (9)

4. box (I)
   a. The box had a picture on the lid. (9)
   b. The boy put the box on the table. (9)
   c. The girl wrote her name on the box. (8)

5. boy (A)
   a. That boy wrote a letter to my sister. (10)
   b. The teacher found a boy under her desk. (10)
   c. One lady bought a balloon from the boy. (10)

6. cake (I)
   a. That cake won the prize at the fair. (8)
   b. She baked a cake for her mother. (8)
   c. She found a spider on the cake. (8)

7. cow (A)
   a. The cow had brown spots on its face. (8)
   b. The farmer milked the cow in the barn. (9)
   c. The boy gave some hay to the cow. (8)

8. fish (A)
   a. The fish blew bubbles in the water. (9)
   b. My father caught a fish in that river. (10)
   c. She saw long, orange stripes on the fish. (8)

9. friend (A)
   a. Her friend gave some gum to the boys. (8)
   b. The boy saw his friend near the tree. (8)
   c. The boys bought a present for their friend. (9)

10. girl (A)
    a. That girl hit my friend in the eye. (8)
    b. My teacher saw a girl in the car. (9)
    c. The boys threw some rocks at that girl. (8)

11. glass (I)
    a. This glass has my name on the bottom. (9)
    b. My brother broke a glass in the bathroom. (10)
    c. The girl cut her finger on the glass. (9)

12. horse (A)
    a. The horse kicked me in the back. (7)
    b. I rode the horse in a circle. (8)
    c. He put the blanket on the horse. (8)

13. key (I)
    a. That key opened the door of the house. (9)
    b. This boy wore a key around his neck. (9)
    c. The lady tied a string on the key. (9)

14. kite (I)
    a. The kite lifted the boy off the ground. (9)
    b. The boy bought a kite for his sister. (9)
    c. The children saw a bird near the kite. (9)

15. knife (I)
    a. That knife has some dirt on its handle. (9)
    b. The thief hid the knife under his shirt. (9)
    c. The boy has some butter on his knife. (9)

16. man (A)
    a. The man lost his keys in the park. (8)
    b. A horse bit the man on the leg. (8)
    c. My friend bought a ticket from that man. (9)

17. milk (I)
    a. The milk had some cream on the top. (8)
    b. Her mother spilled some milk on her dress. (9)
    c. Some children put chocolate in their milk. (9)

18. mouse (A)
    a. A mouse ate the cheese in the trap. (8)
    b. My friend caught the mouse in a box. (8)
    c. The girl gave some bread to the mouse. (8)

19. nurse (A)
    a. That nurse gave me a shot in the arm. (9)
    b. The man saw a nurse in the office. (9)
    c. The boy took a note to the nurse. (8)

20. train (I)
    a. The train took the children to the town. (9)
    b. Six men rode the train to the city. (9)
    c. The police saw some people by the train. (10)

The Test (as administered)

1. The girl lost her shoe in the park.
2. My sister hit me in the mouth.
3. The boys saw the spoon on the table.
4. That dog bit my brother on the leg.
5. The children found a worm in the garden.
6. The police saw some people by the train.
7. A horse bit the man on the leg.
8. The girl cut her finger on the glass.
9. The lady tied a string on the key.
10. The cow had brown spots on (his) its face.
11. My friend bought a ticket from that man.
12. That key opened the door of the house.
13. My friend caught the mouse in a box.
14. The milk had some cream on the top.
15. My father caught a fish in that river.
16. shoe
17. mouth
18. spoon
19. dog
20. worm
21. He put the blanket on the horse.
22. The boy put the box on the table.
23. She found a spider on the cake.
24. The boy gave some hay to the cow.
25. The thief hid the kinfe under his shirt.
26. The boy bought a kite for his sister.
27. That nurse gave me a shot in the arm.
28. Her mother spilled some milk on her dress.
29. The boat had a motor in the back.
30. Six men rode the train to the city.
31. The teacher found a boy under her desk.
32. The men had seven fish in their boat.
33. She saw long, orange stripes on the fish.
34. The man saw a nurse in the office.
35. The boys threw some rocks at that girl.

36. ball
37. train
38. cow
39. fish
40. kite
41. That knife has some dirt on its handle.
42. That cake won the prize at the fair.
43. That boy hit the ball over the fence.
44. The girl wrote her name on the box.
45. A man put the bird in a cage.
46. The girl gave some bread to the mouse.
47. The box had a picture on the lid.
48. This boy wore a key around his neck.
49. One lady bought a balloon from the boy.
50. The train took the children to the town.
51. Two girls gave the food to the bird.
52. This glass has my name on the bottom.
53. His father bought a boat for the race.
54. The fish blew bubbles in the water.
55. A mouse ate the cheese in the trap.

STOP (for break)

56. man
57. knife
58. nurse
59. cake
60. glass

61. She baked a cake for her mother.
62. That boy wrote a letter to my sister.
63. The boy saw his friend near the tree.
64. My brother broke a glass in the bathroom.
65. The kite lifted the boy off the ground.
66. I rode the horse in a circle.
67. The boy has some butter on his knife.
68. The farmer milked the cow in the barn.
69. The children saw a bird near the kite.
70. The bird ate the bread on the ground.
71. The boys bought a present for their friend.
72. The boy took a note to the nurse.
73. The man lost his keys in the park.
74. Her friend gave some gum to the boys.
75. Some children put chocolate in their milk.
76. bird
77. mouse
78. boy
79. friend
80. boat
81. That girl hit my friend in the eye.
82. My dog chewed the cover off the ball.
83. The horse kicked me in the back.
84. My teacher saw a girl in the car.
85. The ball hit John on the head.
96. girl
97. horse
98. box
99. key
100. milk